tinue in motion until something stops it; 2. A body moving in any direction is not retarded by a force exerted at right angles to its direction.

We will suppose the ring to be laid aside, since it serves only for holding the disk, and that the disk or wheel is cut away until only a narrow strip is left, like two arms extending in opposite directions from the axle: its form will then resemble a T-square, which will now be used to illustrate the actions of the gyroscope.

Hold the stem of the square in the left hand, close to the end, and make the cross-piece vertical; hold the left hand still, and let the cross-piece move up or down: evidently it will describe part of a circle. If it is held so that the cross is just in front of a plumb-line, so that both can be viewed at once, it will be seen that the upper end of the cross moves away from the plumb to the right, while the lower moves away from it also, but to the left. If, while the left hand remained stationary, the cross had been allowed to drop freely, the top and bottom would evidently acquire a certain horizontal motion, one to the right, the other to the left. If, now, the T-square be quickly turned over, so that the top and bottom change places, this will not interfere with motion previously acquired: the bottom (which has now become the top) will continue to move to the left, while that which was the top will move to the right; and, as the motion continues (as in case of a pendulum), the ends of the cross are pushed back to where they were, and the instrument rises to its first position.

This explains why the gyroscope, in apparent defiance of the law of gravity, remains, when supported only at one end, in a horizontal position.

To understand why the instrument rotates around the central point, in a direction always the opposite of that of the top of the disk, the T-square is again brought into service. Hold it as before, and let it fall a few inches: as in the first experiment, the top, when the T goes down, gets a motion towards the right; but, before the instrument can be reversed, it must go half way, and point horizontally, instead of up and down. Evidently the motion which sends the upper end to the right will push the instrument (if the top was revolved towards the south) towards the north: hence the horizontal motion.

The horizontal motion is slow in proportion as that of the disk is rapid, because of the movement of the arms of the T. If the T turns slowly, it has more time to give motion to the ends of the arms, and consequently they push it around faster. If the T turns very quickly, it falls a very short distance (has so little time): hence the ends of the arms get very little motion, and, of course, can impart but little. A quick motion of the disk, therefore, makes a slow horizontal movement, and a slow motion of the disk makes a quick horizontal movement.

A careful consideration of the above will make it easy to see why the gyroscope ceases to maintain itself if the lateral (or horizontal) motion is stopped; for, in order to maintain itself, the motion imparted to the ends of the T-square, when vertical, must be expended in lifting: if spent in any other way, nothing is left to overcome gravity. Now if, as the square falls, and the T has become horizontal, some obstacle prevent its moving still farther to the right, its motion in this direction would cease; and, of course, when it arrived at the lowest point, nothing would be left to lift the instrument.

Another paradox is, that the instrument must fall somewhat, in order to produce any of its peculiar phenomena; but this, too, is easily explained. Every thing depends upon the two extremities of the T getting a motion, one to the right and the other to the left, when the T is vertical. If the T does not fall, or if it is not lifted up (for either movement will do equally well), there will be no such motion: only, if the first sends the instrument north, the other will send it south.

This directly or impliedly explains all the phenomena of the gyroscope.

NOTES AND NEWS.

THE death of Guyot has been soon followed by that of another of the notable scientific men, who, educated in Europe, took up their lot with us, and became, so to say, wholly our own. Dr. George Engelmann of St. Louis — our oldest botanist (excepting the venerable Lesquereux), as well as an eminent physician, for a time a fellow-student with Agassiz in Germany — died on the 11th inst., at the age of seventy-five. A biographical notice may be expected in an ensuing number.

— The *Journal of agricultural science* proposed from the North Carolina agricultural station recently, and to which we referred Dec. 28, has met with universal approval and most unexpected support.

Nearly one hundred shares of stock have been taken upon the plan proposed; and the Houghton farm proposes to assume all of the mechanical work of a monthly journal, and guarantee this part of its expense for one year. Without any special effort to secure them, about three hundred subscribers are reported.

In response to a cordial invitation of the commissioner of agriculture, a meeting will be held to organize this enterprise, at the Department of agriculture at Washington, at ten A.M., Wednesday, Feb. 27. All the friends of the scheme are urged to be present at this meeting, and participate in the inauguration of the journal. It is hoped that each agricultural college, experiment-station, etc., will send a representative.

— Commodore Samuel R. Franklin, U.S.N., has been detached from duty on the naval examining board, and ordered as superintendent of the naval observatory, to succeed Rear-Admiral R. W. Shufeldt, who was placed upon the retired list on Feb. 21.

— At a concert given by the Choral club of the University of Wisconsin on the evening of Feb. 8, two songs by Sir William Herschel were sung, — the first, a glee, 'Go, gentle breezes;' the second, a catch,

'They say there is an echo here.' The manuscript copies of this music were loaned by the college library.

— The American ornithologists' union, with the enthusiasm of new institutions, has taken up the English sparrow question in an energetic and scientific way. A committee of the association has issued a circular asking answers to a series of twenty-eight questions. The value of the replies, especially to the later questions, will vary exceedingly; and we should judge it exceedingly difficult to assign them their proper relative value. Nevertheless, the general conclusion the committee will reach as to whether the bird is, on the whole, injurious or beneficial to agriculture, will not be likely to be disputed. The committee has divided the field among its members, Mr. Montague Chamberlain of St. John taking the British provinces; Mr. N. C. Brown of Portland, the three northern New-England states; Mr. H. A. Purdie, the other New-England states; Mr. E. P. Bicknell of New York, New York and the Western states; and the chairman, Dr. J. B. Holder of New York, the Southern and Middle states. The committee intends to construct a map of the present geographical distribution of the sparrow; and any volunteer information by those not reached by the circular will be gladly received by the chairman, who may be addressed at the American museum of natural history, New York. The authorities in Bermuda already offer bounties for the destruction of the sparrow, although heavy penalties are laid on the destruction of other birds on that lonely island.

— The sixth Saturday lecture of the Washington course was delivered on Feb. 9, in the lecture-room of the National museum, by Capt. C. E. Dutton, U. S. A., on 'The Hawaiian Islands and people.' Capt. Dutton visited the islands two years ago, in the interest of the Geological survey, to study the volcanic phenomena there for purposes of comparison with the region of extinct volcanoes in the western part of our own continent. His lecture was devoted in large part to a discussion of the geology of the Hawaiian group. An audience of about eight hundred was present. Mr. H. C. Burchard, director of the Mint, occupied the chair; and at the close a vote of thanks was moved by Major J. W. Powell.

— The Fish-commission steamer Albatross, now cruising in the Caribbean in behalf of the Hydrographic office, arrived at St. Thomas, Jan. 17, after a seven-days' voyage from Norfolk, and, after coaling, started on the 24th for Curaçoa, where she was due on the 14th of February. While at St. Thomas, the naturalists of the ship made considerable collections of birds and shallow-water invertebrates.

— Mr. F. W. True, curator of mammals in the National museum, is now at the British museum, studying the types of cetaceans, and especially of the Delphinidae, with the view of settling some important questions in the nomenclature and relations of the North-American forms. It is probable that his studies will demonstrate the identity of many of our Atlantic species, described as distinct by Agassiz, Cope, and others, with long-known European forms.

— At the November meeting of the Society of biblical archaeology, London, Mr. Budge of the British museum read a paper on the fourth tablet of the series of cuneiform texts relating to creation. Mr. Rassam has recently found a large Babylonian fragment of this fourth tablet. The language of the tablet is vigorous, and, like that of many of the cuneiform hymns, approaches in dignity the majestic roll of the Hebrew psalms. The deepest interest in connection with the tablet is the apparent acquaintance with rhyme and rhythm. Mr. Budge does not give enough of the original to aid us in testing this subject, but what he does give is favorable to the supposition. A peculiar kind of alliteration in the Babylonian cuneiform writing is already familiar. The fragment of a hymn on pp. 15 and 16 of Mr. T. G. Pinches' 'Texts in the Babylonian wedge-writing' is divided into stanzas of five lines each, and the same syllable begins each line of the stanza. There are five lines beginning with *ar*, five with *ba*, five with *su*, etc.

— The London papers are now discussing the desirability of opening the various museums of that city in the evening, for the benefit of that large class who have no command of their time during the day. The *Globe* is filled with letters on the subject. This discussion is called forth by the rumor that a bill will be presented in Parliament at the next term, for the opening of several of the more important art-galleries, museums, etc., after business-hours. South Kensington museum, and the Museum of practical geology, are now open from ten A.M. to ten P.M. on Saturdays, Mondays, and Tuesdays. There is no doubt but that these evening sessions are very useful, especially to that great and intelligent class of persons who do not belong to the group of 'workingmen' as that word is generally understood, but who, nevertheless, earn their living by work during the day, and have only the evening in which to gain information and widen their mental horizon. Many of our own cities would be greatly benefited if the museums and art-gallery could be opened in the evening.

— It has been the feeling for some time past in Germany, that that country should have a meteorological society. The want of this has been met by the publications of the Austrian society; but now that meteorology is making such rapid strides, and so many are becoming interested in it, there is much reason for the recent move made by the German meteorologists.

On Nov. 18, 1883, the following well-known contributors to our knowledge of this science met at Hamburg to ground a 'Deutsche meteorologische gesellschaft:' Assman, van Bebber, vo nBezold, Börgen, Börnstein, von Danckelman, Dinklage, Ebermayer, Hellmann, Honsell, Karsten, Klein, Koch, Köppen, Krebs, Müttrich, Neumayer, von Schroder, Schreiber, Sprung, Thilenius, Zöppritz. Many others sent letters expressing their intention to give aid to the project. The first general meeting of the society

will take place in September, 1884, at Magdeburg. Dr. Neumayer is president.

The aim of the society is to pay attention to the science of meteorology, as well as its relations to practical life. As a means of accomplishing this, 1°, meetings of the society and its branches will be established; 2°, a journal of meteorology will be issued; 3°, meteorological investigations will be aided, partly directly, and partly through its branches; 4°, lectures and other measures will be introduced for the distribution of meteorological knowledge in wider circles. The members are to be honorary, foundation, ordinary, and corresponding. The yearly assessment for ordinary members is ten marks ($2.50).

From private letters we are informed that the first number of the journal will be issued in a couple of months. It might seem at first as though this new journal would interfere with the work of that excellent journal, the *Oesterreichische zeitschrift für meteorologie*; but we believe that the editors of the journals will enter into such relations with each other that the two journals shall be supplementary the one to the other. It may be expected that this new journal will occupy as important a place as the Austrian, and therefore it ought to find its way into the hands of all those who wish to keep informed of the progress of this science. The *Deutsche seewarte* at Hamburg will naturally be the chief seat of work in connection with the issue of this journal. The treasurer of the society is Mr. Ernst Bopp, Königstrasse, No. 6 II, Hamburg.

— The M. P. club, a club of mathematicians and physicists living in Boston and vicinity, which meets once a month for the discussion of vexed questions in their departments, has issued the following list of subjects for discussion:—

1. Given a solid body in which the moments of inertia about four axes passing through one point are equal, does it follow that the moments of inertia about all axes, through the same point, are the same? 2. Are there any general methods for determining the form of a function when certain special values are known, or when certain conditions are given? For example: (*a*) To find $F(x, y, z)$, given $F(x, x, z) = 0$, and $F(x, y, z) = 1$. One solution is $F(x, y, z) = \frac{x - y}{z - y}$: what others are there? (*b*) $p = F\left(\frac{u}{v}, \frac{du}{dv}\right)$, $t = \dot{F}\left(\frac{u}{v}, \frac{du}{dv}\right)$: given $\frac{dp}{dv} + \frac{p - t}{v} = 0$, also given, that, when $\frac{u}{v}$ and $\frac{du}{dv}$ are interchanged, then p and t are interchanged, to find F and $\dot{F}$. 3. "Is it, therefore, an essential condition of equilibrium that $p(X\,dx + Y\,dy + Z\,dz)$ should be a perfect differential of some function?" (W. H. Besant's 'Hydromechanics,' p. 13.) "In this case of compressibility, $u\,dy - v\,dx$ is not the differential of any function; so that the function F does not exist, although, of course, stream lines exist" (Minchin's 'Kinematics,' p. 152). Such passages as these suggest the inquiry, "How are we to interpret physically the fact that a given differential is not an exact differential?" (see Clausius' 'Mechanische wärmetheorie,' p. 4.) 4. The graphical treatment of algebraic problems (see Vose's little book on the subject, published by Van Nostrand). 5. Graphical statics. 6. Anharmonic ratios; suggestions of new nomenclature. 7. Koenig's researches on beats and beat tones. 8. Euclid's doctrine of proportion. 9. Multiple algebra. 10. The comparison of Grassmann's theory of extension and Hamilton's quaternions. 11. Imaginaries in quaternions. 12. Weierstrasse's investigations in analytics and geometry. 13. The precise nature of the ancient problem of the quadrature of the circle. 14. The twelfth axiom of Euclid. 15. The bearing of the modern conception of non-Euclidean space on our theory of the foundation and certainty of geometric truth. 16. The true relation of hyper-space analytics to questions of actual existence. 17. Riemann's surfaces. 18. The meaning of an infinitely distant point on a straight line. 19. $\frac{1}{\infty}$ does not equal $a - a$. 20. Cayley's exposition of the logical structure of plane geometry ('Encycl. Brit.,' 9th ed.). 21. The synthetical (as opposed to analytical) character of all judgment and proof that is strictly mathematical. 22. The development of algebra from first principles as the science of pure time. 23. The calculus of logic. 24. The writings of François Viète. 25. Comparative merits of the method of limits and method of infinitesimals in elementary methods. 26. The same in the exposition of the higher calculus (with especial reference to Johnson and Rice's new 'Method of rates'). 27. Is gravitation a truth empirical, or *a priori*? and the limits of Newton's law of rate in gravity. 28. The principle of least resistance. 29. What exactly is meant by the correlation of forces, and what is its bearing on the conservation of energy? 30. The dissipation of energy. Its meaning and bearing on the stability of the universe. 31. Recent researches upon the atomic theory and upon the resolvability of the elements. 32. What constitutes the chief resistance in the case of a body moving through the water? 33. What is the form of least resistance for a row-boat? What for a sail-boat? What for a steamer? 34. Cause of capillary ascensions and depressions. 35. The means whereby water is able to penetrate capillary tubes against a superior pressure of a gas (see Daubrée's 'Études synthétiques de géologie expérimental,' Paris, 1879). 36. Microscopic action. 37. The diathermancy of ice from the point of view of James Croll's theory of glacial motion. 38. Direction of electric currents in diamagnetic bodies, e.g., bismuth. 39. Underground telephone circuits. 40. Elasticity and permanent set. 41. Diffraction gratings, plane and curved. 42. A short discussion (not too technical) on some of the instruments of research, such as the bolometer and the inductive balance. 43. Recent researches on the distance of the sun. 44. The origin of meteorites: are they volcanic ejections? 45. The aurora borealis, zodiacal light, etc. 46. If steam be enclosed in a cylinder open on the outside to the air, and compressed, is it possible to get a compression curve concave downwards (abscissae representing volumes, and ordinates pressures), and, if so, when?